THE DIET IN TYPHOID FEVER.[1]

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In the absence of specific therapy, the importance of diet cannot be overestimated. This fact was keenly appreciated by the old masters in medicine: a casual historical retrospect shows the fever-besieged patient stimulated to the utmost with medicine and food, or subjected to the mercies of depleting drugs, venesection, and starvation, according to the prevailing dicta of the day. As physicians began to classify diseases, treatment, including diet, became more rational; but until the laboratories contributed their share to our knowledge of the functions of the body in health and disease, dietary rules were mainly empiric. Graves "fed fevers" because he saw excellent results from feeding. At present the clinician is influenced by the knowledge which results from scientific activity in the laboratories; he not only knows the exact anatomical changes produced by the disease he is treating, but he also has at his command an ever-increasing fund of facts relating to disturbances of function or to the complex problems of the chemistry of the body. Normal metabolism is in general understood, and much light has been thrown on the more difficult question of metabolism in disease. The conclusions from laboratory experiments are made doubly valuable or are nullified for practical purposes by a careful application of results at the bedside, and the spirit of modern medicine demands such a correlation.

This relation between the laboratory and the ward—the science and the art—has been especially prominent in the more recent studies on typhoid fever. In this paper I shall bear this point of view in mind as I briefly review the underlying principles of nutrition in typhoid fever, the conclusions drawn from the application of these principles to experimental studies, and finally the results of testing these conclusions at the bedside.

Various as are the manifestations of typhoid fever, there is yet one feature common to all cases: the course of the illness is a long-drawn-out battle between the patient and the disease. Since in all battles the strength of the combatants is to be preserved, this rule of more actual warfare is adopted in medicine to the conflict with such diseases as tuberculosis and septicemia. Starvation is in itself a disease with various symptoms due to disturbed metabolic processes, and if Ewing's[2] work is correct most of the symptoms of typhoid fever are caused by somewhat similar metabolic changes. Leaving for later consideration certain specific theoretical and practical objections to this statement and accepting as true the broad comparison, it becomes evident that in typhoid fever our therapeutic goal should be the strengthening of our patient to the full limit of good, without harming him. Food at once must be considered the main weapon in our hands, and we should provide a diet with sufficient nutrition while we remember the handicaps under which the patient fights. Milk, which contains all the elements of a proper food in convenient form, has for long been esteemed the ideal diet for such a condition, and yet with patients on the milk diet as ordinarily practised loss of weight has been a striking feature of most cases of the disease. From a large series this loss has been estimated to amount to 200 to 600 grams daily (7 to 20 ounces), made up of water, fat, and the protein of body tissues, the greater part probably coming from the destruction of body tissue. By determining the amount of nitrogen in food, feces, and urine, it is in general easy to learn how much protein is absorbed from the food supply, and how great is the protein loss from the body tissues. In a table of statistics of 178 experiments collected by Nichols,[3] it is well shown that an insufficient supply of food nitrogen results in poor absorption and extensive nitrogen loss, while with a more liberal supply of nitrogen (16 to 20 grams) about 88 per cent. is absorbed, and the nitrogen loss is reduced to a minimum of 3.7 grams per day. Practically this means that starvation is the greatest cause of the loss of body weight, and that sufficient food would prevent to a great extent the loss of weight.

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[1] Read at the Semi-annual Meeting of the Southwest Virginia Medical Society, Bristol, Virginia, December 3 and 4, 1908.

[2] Nitrogen metabolism in Typhoid Fever. Med. Record, March 30, 1907, p. 537.

Exactly how much of the emaciation is due to the pyrexia or to the toxemia or to both is difficult to estimate, although it is known that by artificially raising the body temperature an increase of protein metabolism does occur. On the other hand, it has also been shown both in laboratory and bedside experiments that an increase in the diet will decrease protein destruction even in fever, and the opinion of most investigators is that a more liberal diet prevents to a great extent the protein loss due to fever as well as that due to starvation.

That the ordinary typhoid-fever diet does not prevent this emaciation is evident, and the reason is clear. A normal resting individual weighing 70 kilos (150 pounds) and receiving sufficient food expends about 33 calories per kilo of body weight per day, or a total of 2300 calories. In fever there is approximately an increased heat production of 25 per cent., which added to the 2300 calories makes 2800 calories. If a fever patient does not have this amount of energy supplied in his food he will burn up his own tissues to supply the deficit. If he receives 1500 to 2000 c.c. of milk per day, as in the ordinary milk diet, he receives about 1000 to 1400 calories only. The

[3] Diet in Typhoid Fever. Fiske Fund Prize Dissertation No. 50. Providence. 1907 (contains complete bibliography).

liquid diet, of which milk is always the main constituent, has about the some caloric value. If all typhoid subjects were to get 3 to 4 liters of milk daily the problem of typhoid-fever feeding would be simple, but for many very obvious reasons this is impossible, and we must look for additional food to supply the deficiency.

It is almost a traditional belief in medicine that milk and other liquids are the most easily digested and absorbed, as well as the least likely to excite harmful peristalsis in the inflamed intestine, but there is certainly not sufficient evidence to prove this assertion. As a matter of fact, experiments performed on typhoid fever patients during the febrile period of the disease show that the absorption of most easily digested foods, including milk, is on the average 5 to 10 per cent. less than in a normal person. Further, excluding foods with a heavy vegetable residue it is impossible to prove that food, such as an egg or a piece of meat, will reach the inflamed Peyer's patches in more solid form than milk which enters the cardiac orifice of the stomach a liquid and leaves the pylorus a solid.

But, after all, the proof of the typhoid diet is in the eating, and we must look to actual results of various diets for the final test. Barrs,[4] in 1897, wrote about a less restricted diet that "it is likely to modify favorably the death rate, to shorten convalescence, to diminish the risks of complications and sequelæ, and to make typhoid fever a less formidable and more manageable disease than it is under our present standard methods of treatment." Before and since that time observations have been made by clinicians in various countries with diets varying from the mere addition of soft eggs or soft toast to one containing meat, and as far as I have been able to determine not a single adverse report has come from any observer who has had the courage to try a more liberal diet. In this country Shattuck[5] was the first to point out the advantages of a more liberal diet, and Thayer,[6] by calling attention to the excellent results obtained by certain Russian investigators, stimulated further active interest in the subject. Litchfield[7] also has recently written on the subject. Kinnicutt[8] collected the available statistics up to 1906, with the results seen in Table I.

TABLE I.

No. of cases.	Relapses.	Per cent.	Hemorrhages.	Per cent.	Perforations.	Per cent.	Deaths.	Per cent.	
733	48	11.3	35	4.7	10	1.3	60	9.4	Liberal diet.
4654	507	10.8	411	8.8	111	2.4	491	10.5	Liquid diet.

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[4] A Plea for a Less Restricted Diet in Typhoid Fever. Brit. Med. Jour., 1897, i, 125.
[5] Diet in Typhoid Fever. Jour. Amer. Med. Assoc., July 10, 1897, p. 51.
[6] Progressive Medicine, 1899.
[7] Nourishment of Patients during Typhoid. Penna. Med. Jour., October, 1908.
[8] Principles of Feeding in Typhoid and in other Fevers. Boston Med. and Surg. Jour., clv, i, 1.

It is seen that the death rate is lower, there are fewer perforations and hemorrhages, and a slight increase in relapses in those cases liberally fed.

An analysis of the cases treated at the Johns Hopkins Hospital from July, 1906, to July, 1908, inclusive, to which I am allowed to refer by the courtesy of Professors Barker and Thayer, shows the following results (Table II).

TABLE II.

	No. of cases.	Hemorrhages, per cent.	Perforations, per cent.	Relapses, per cent.	Abdominal pain, per cent.	Nausea, vomiting, per cent.	Distention, per cent.	Hypothermia, per cent.	Tachycardia, per cent.	Deaths, per cent.
Series I. Liberal diet.	98	13.3	3.0	18.3	26.5	15.3	7.0	44.3	51.1	6.1
Series II. Liquid diet.	149	16.7	3.3	12.7	30.8	17.4	9.4	53.1	42.0	12.7

The 149 cases in Series II include about 75 who received only milk and albumin water, approximately from 700 to 1000 c.c. of each daily, a few extremely ill cases who received albumin water only, and about 70 who had broths in addition. The 98 cases of the first series include all patients who were given, during the febrile period, any soft or semisolid food—some received simply one soft egg three times a day in addition to liquids, others got also soft toast, but most were allowed the choice of eggs, toast, thin gruels, custard, junket, and jelly. There was no rule of selection of cases, but patients who were extremely intoxicated on entering the hospital generally would not take more than liquids. This probably means that, on the whole, the fed cases were slightly milder than those of Series II. Both series include cases from all seasons of the year, the patients were from the same walks of life, and were given identical treatment except for the diet. In all cases water was freely given. Both tables show that there is no justification for the fear felt by some about the possible increase of complications following more food, and with the exception of the increase in relapses the results are all in favor of a freer diet. In the Johns Hopkins cases the deaths in Series I were due in three instances to perforation, in two to toxemia, in one to hemorrhages; one patient was in the hospital only two days before the exitus. To avoid unfair comparisons the deaths in Series II must be explained. Six patients were in the hospital from one to six days before dying: one from acute nephritis, one from typhoid meningitis associated with general peritonitis due to a gangrenous appendix, four from the extreme toxemia. Further, one death was due to intestinal strangulation caused by adhesions from an old gynecological operation. Of the 12 remaining, 4 died from perforation, 1 from a scrotal abscess, 1 from pneumothorax, and 6 from the effects of the toxemia. Therefore, one is not by any means justified in concluding from these comparative death rates that a more liberal diet lowers the mortality 50 per cent. The incidence of hemorrhage and perforation is less; the rather large difference in the number of relapses was surprising, but the small number of cases may easily account for this. As relating to the digestibility of the respective diets, it is interesting to note that abdominal pain, nausea, vomiting, and distention are present to a less degree in Series I than in Series II. Diarrhœa is such an uncommon feature of typhoid fever at the Johns Hopkins Hospital that notes on its very occasional presence have no value in the present analysis. Hypothermia was distinctly less marked in Series I, not only in percentage values, but also in the degree to which it was present in the individual cases. The increase in the percentage of tachycardia is possibly due to the fact that the patients of Series I were let out of bed earlier.

In order to determine any possible effect of diet on the length of the disease, calculations were made of the average length of pyrexia and of duration of illness. The results are expressed in Table III.

TABLE III.

	Duration of fever.	Duration of illness.	Convalescence.	
Series I. Liberal diet.	34.2	52.4	18.2	Days.
Series II. Liquid diet.	32.9	53.0	20.1	

Only those patients who recovered were included in this list. The temperature was considered normal only when it was 99° in the rectum for a whole day and remained so. In case of relapse, the first day of normal temperaure following the relapse was used in the calculation. It is seen that in the cases fed the duration of pyrexia was slightly longer, as is to be expected from the increased number of relapses; but the total length of the illness is shorter, and convalescence is almost two days less.

In typhoid fever results may follow certain lines of treatment, not because of the treatment, but rather as co-incidental happenings: consequently, results such as these must be accepted conservatively. Certainly physicians who have treated patients in both ways agree that convalescence is less formidable; that the necessary increase in diet during convalescence is a far easier task; that the patient is much more comfortable; and that his general condition is better after an attack of typhoid during which his dietary is "liberal." Such a liberal diet has been tested sufficiently to warrant the conclusions not only that it is not harmful, but that it offers distinct advantages over the low diet. The distressing hunger and extreme emaciation are symptoms which can be prevented in most cases; and with care in the selection of food we should not only be able to do this, but we should also be able to stimulate the psychic factor of digestion and thus allow of better absorption than is possible with distasteful food. It still remains for the hospital laboratory to determine the ideal proportions of fat, carbohydrate, and protein in a typhoid-fever diet. Schaffer's[9] recent work with a high carbohydrate ratio is most suggestive. Although the chemical composition and the caloric value of any food can be found in published tables, for general purposes outside of hospitals it is sufficient to choose a dietary from a wide variety of digestible foods, such as has been used by Shattuck (appended below). No absolute rules can be laid down, and all patients cannot be freely fed. A hospital physician can order articles of diet for his typhoid-fever patients which a country practitioner would find absolutely impracticable. The question is not of a choice of solid or liquid food, but of sufficient food selected so as best to supply the wants of the organism without harming the patient.

The conclusion drawn from this study is, that, while details of diet cannot be prescribed by dogmatic rules, the underlying principle in feeding typhoid fever patients should be to furnish at least the same amount of food energy required by a healthy resting person.

Shattuck's Dietary: Milk, hot or cold, with or without salt, with lime water, soda water, Apollinaris, Vichy; peptogenic or peptonized milk; cream and water; milk with white of egg and slip; buttermilk; koumyss; matzoon; whey; milk with tea, coffee, cocoa.

Soups: Beef, veal, chicken, tomato, oyster, mutton, pea, bean, squash, carefully strained and thickened with rice, arrowroot, flour, milk, egg, cream, barley.

Horlick's, Mellin's, malted milk, carnipeptone, bovinine, somatose, beef juice.

Gruels: Strained cornmeal, crackers, flour, barley water, toast water, albumin water, lemon water.

Ice cream.

Eggs: Soft boiled, raw, eggnog.

Finely minced lean meat, scraped beef, soft part of raw oysters, soft crackers with milk or broth, soft puddings without raisins; soft toast without crust; blanc mange, wine jelly, apple sauce, macaroni.

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[9] Metabolism in Typhoid. Jour. Amer. Med. Assoc., September 19, 1908, p. 974.